

PC2005 / PC2010 / PC2015

Insert Series for Finishing High Hardness Steel



Laser Mill Series

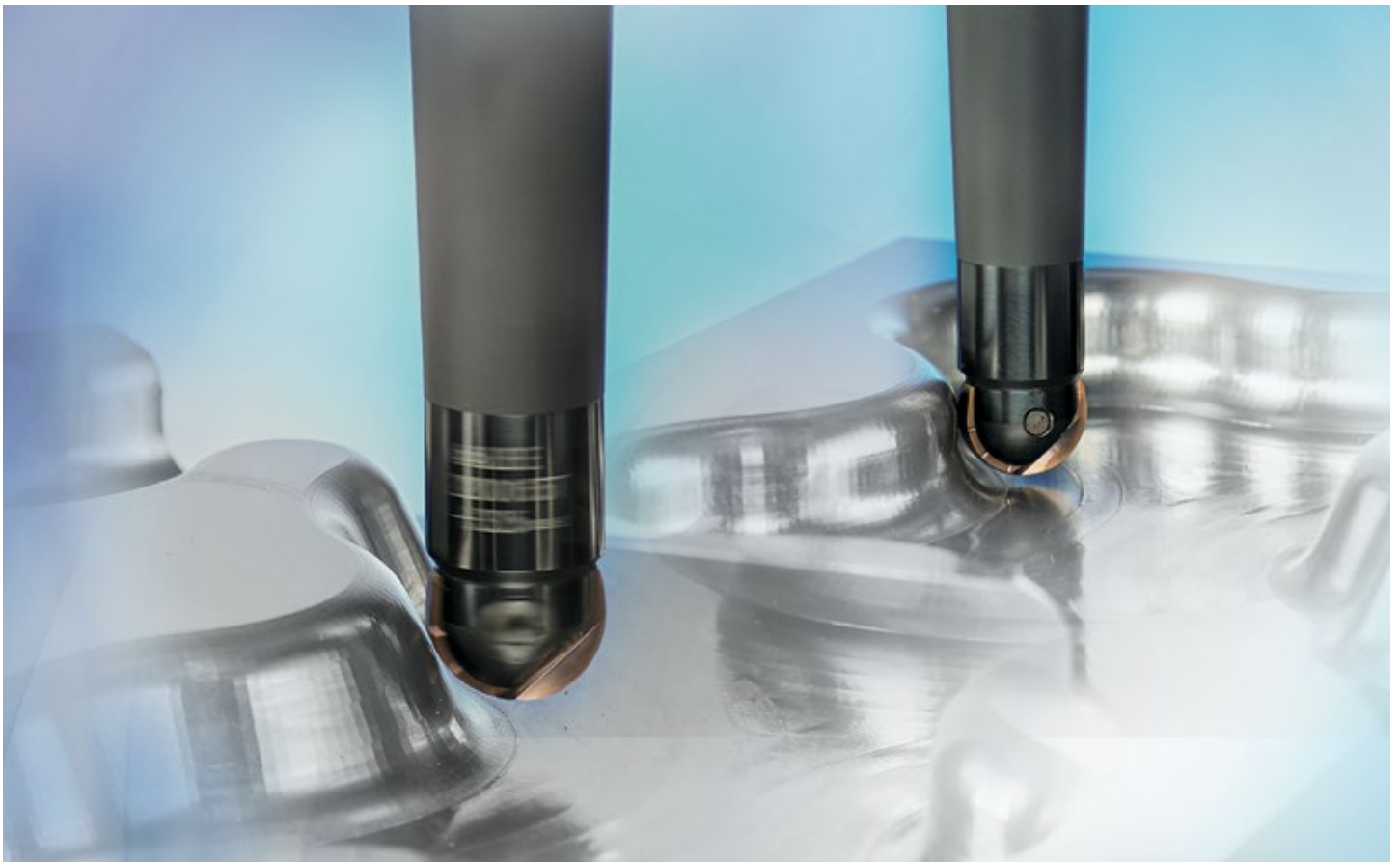
New Laser Mill series for high hardness steel and for universal purpose covering all die steel

■ PC2005 / PC2010 / PC2015

Outstanding increase of wear resistance through optimized grade per workpiece

■ KF / KH Chip Breaker

Increased strength and design of cutting edges through optimized blade geometries per workpiece



Insert Series for Finishing High Hardness Steel



PC2005 For high hardness steel
and press die steel



PC2010 For pre hardened steel
and plastic die steel



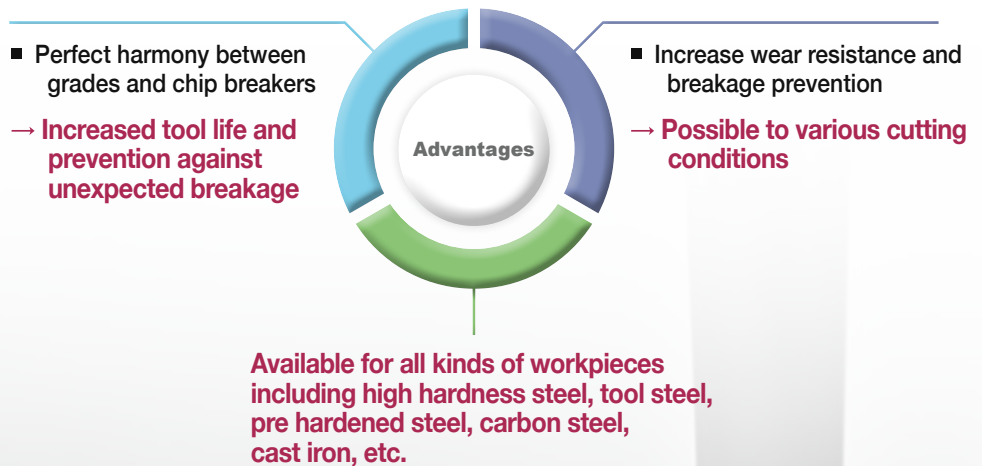
PC2015 For carbon steel
and cast iron

Laser Mill Line-up optimized for machining die and mold die and mold using material such as high hardness steel, tool steel, pre hardened steel, etc.

PC2005 Tool steel or high hardness steel after heat treatment has very high hardness that causes severe wear on relief surface of cutting edges during cutting actions, as well as chipping due to heavy cutting loads. In order to prevent these problems, we progressively improved wear resistance and chipping resistance of the substrate by applying ultra fine raw materials to PC2005.

PC2010 In cutting conditions when cutting fluid is applied, thermal cracks occur on tool's surface due to repetitive thermal impact. To avoid thermal cracks, we applied a heat shield coating to PC2010. In addition, it was optimized for wet machining of pre hardened steel by using ultra fine raw materials and high binder on substrate and thus increasing stability.

PC2015 When machining carbon steel and mild steel, wear that looks like bites on tool's relief surface is caused by viscosity between tools and workpieces. PC2015 guarantees excellent tool life and machining stability with its characteristics of the high toughness substrate and the welding resistant coating with low reactivity to workpieces.



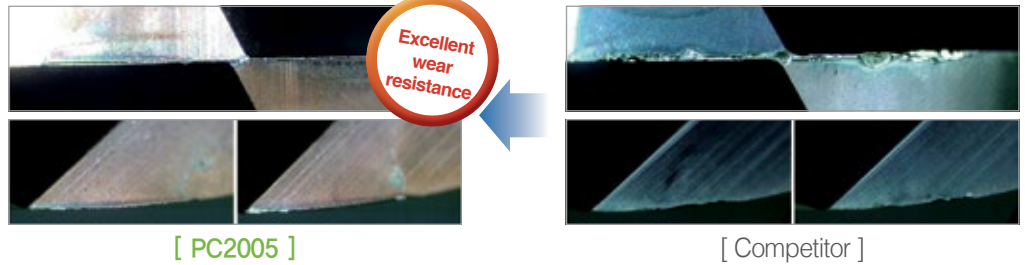
PC2005 (For high hardness workpiece and press die steel)



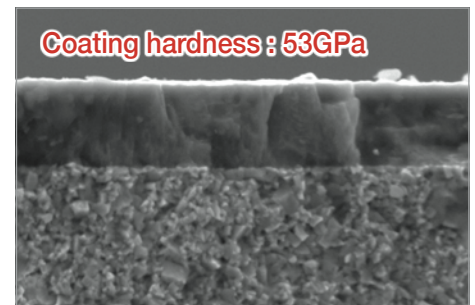
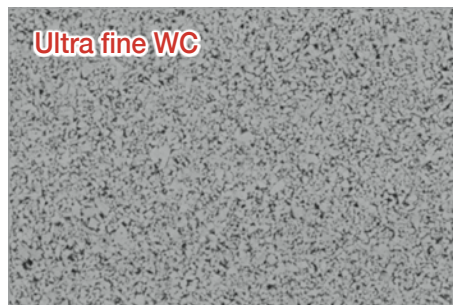
- Super high hardness substrate and coating improve wear resistance dramatically.

High hardness substrate prevents chipping and wear on relief surface.

Wear comparison



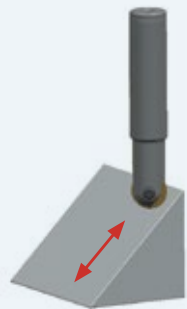
Super high hardness substrate and coating



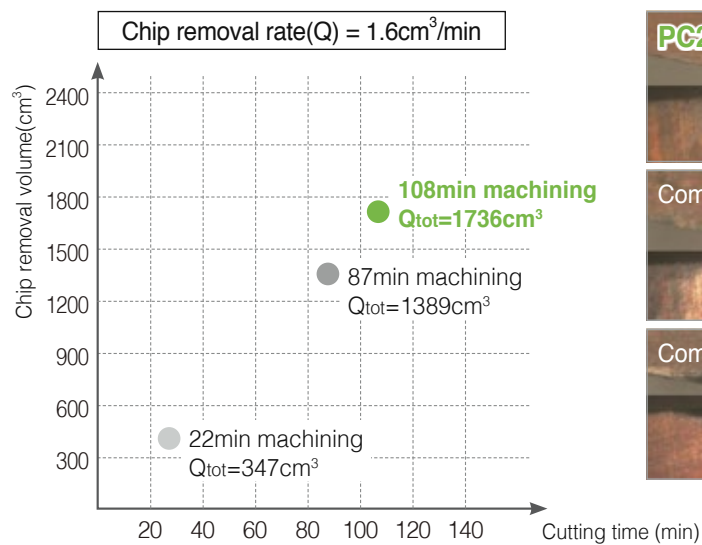
Performance Test

PC2005 tool life test

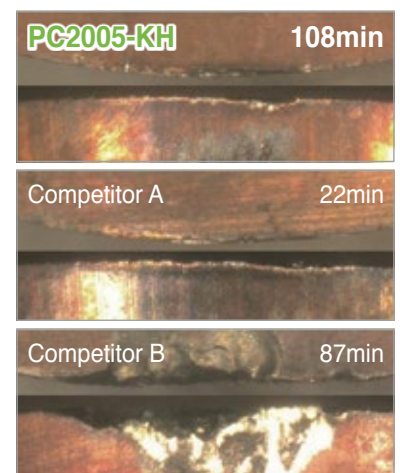
- Workpiece High hardness heat-treated steel [X100CrMoV5 1(DIN), heat-treated HRC60]
- Cutting conditions $vc(m/min) = 140$, $fz(mm/t) = 0.15$, $ap(mm) = 1.2$, $ae(mm) = 1.2$, dry
- Tools Insert LBH120-KH (PC2005)



[Machining type]



● PC2005 ● Competitor A ● Competitor B



Insert Series for Finishing High Hardness Steel

PC2010 (For pre hardened steel and plastic die steel)



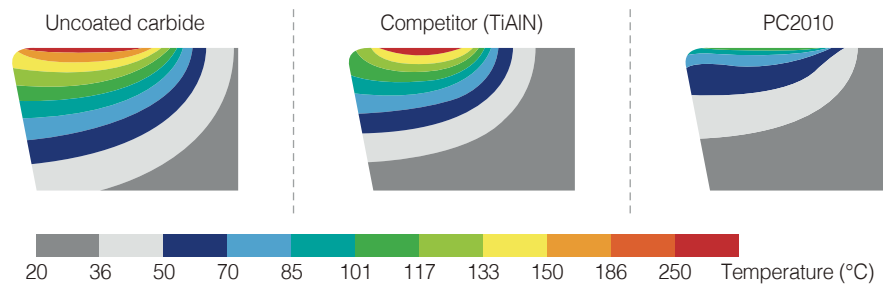
- Ultra fine WC and high contents cobalt were applied to the substrate to expand application range to high hardness steel and pre hardened steel.

- Heat shield coating was applied to prevent thermal crack.
- Ultra fine WC was combined with high contents cobalt to be optimized for machining pre hardened steel.

Wear comparison



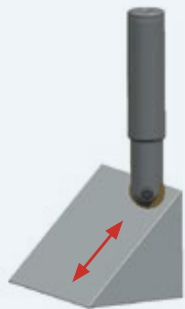
Result of heat conductivity



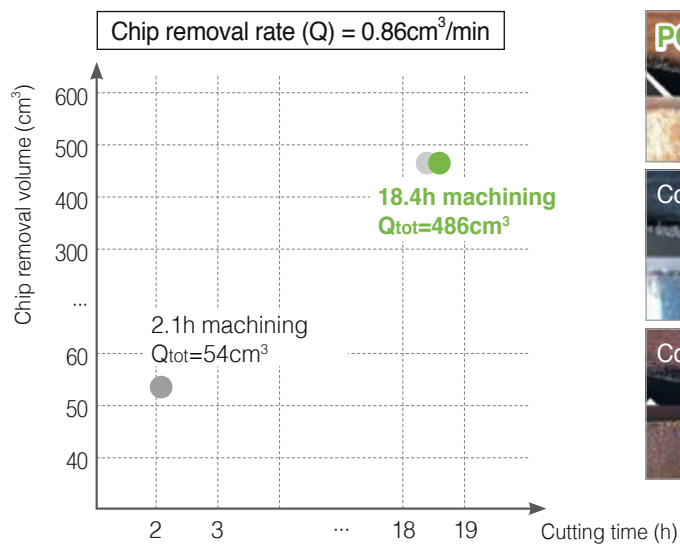
Performance Test

PC2010 tool life test

- Workpiece Pre hardened steel [1.2738 improved (DIN)]
- Cutting conditions vc (m/min) = 276, fz (mm/t) = 0.15, ap (mm) = 0.3, ae (mm) = 1.2, dry
- Tools Insert LBH120-KH (PC2010)



[Machining type]



● PC2010 ● Competitor A ● Competitor B

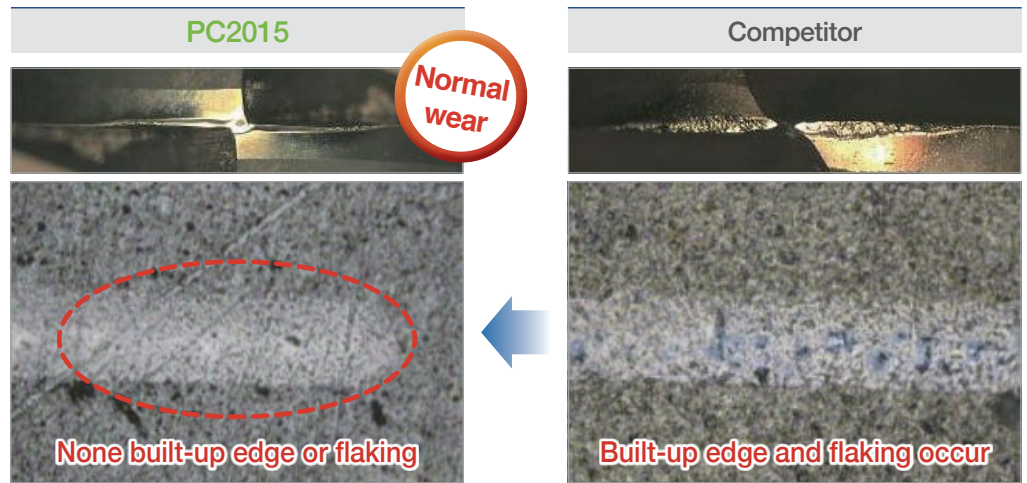


PC2015 (Exclusive for Laser Mill for machining cast iron and carbon steel)



- High toughness substrate based grade for general cutting of cast iron and HRSA with the use of lubricative coating layer.

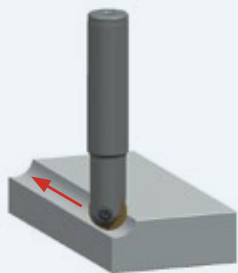
- High toughness substrate and coating layer less responsive to workpiece applied.
- Excellent tool life due to minimized wear and flaking



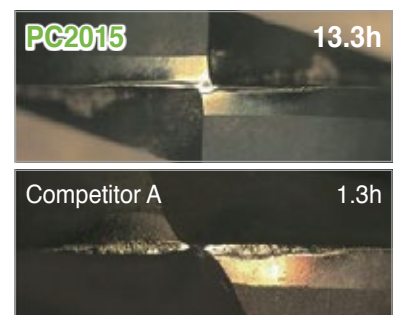
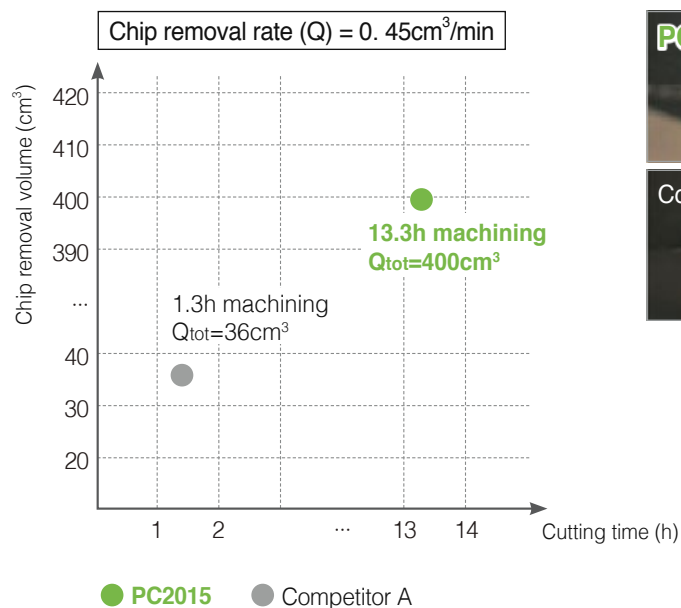
Performance Test

PC2015 tool life test

- Workpiece Carbon steel (C45)
- Cutting conditions vc (m/min) = 250, fz (mm/t) = 0.35, ap (mm) = 0.3, ae (mm) = 0.3, dry
- Tools Insert LBH120 (PC2015)



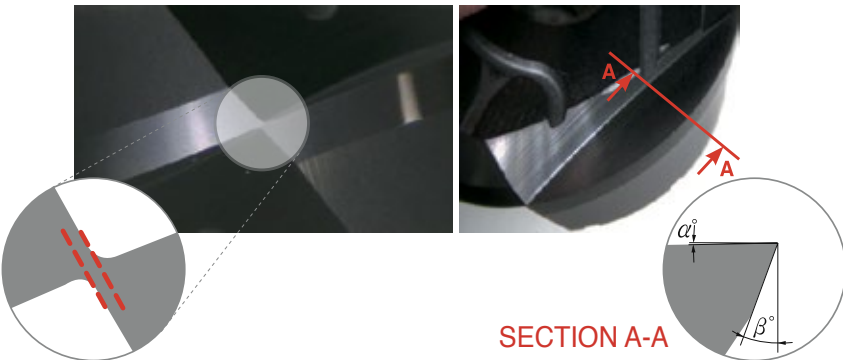
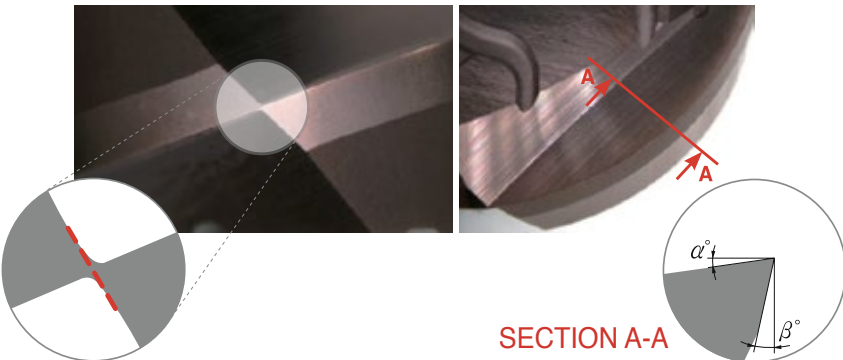
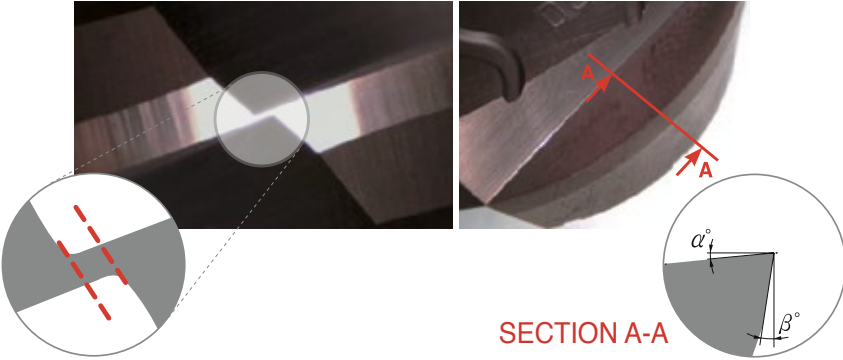
[Machining type]



Insert Series for Finishing High Hardness Steel

➤ Features of KF / KH Chip Breaker

- **KF**: Exclusive chip breaker for stable machining of carbon steel with its characteristics of high wear resistance at center part and improved blade design.
- **KH**: Stronger insert with the combination of rake angle and relief angle that are ideal for machining high hardness workpiece.

Type	Shape comparison
Standard (For general cutting)	 <p>SECTION A-A</p> <ul style="list-style-type: none"> ■ Proper to general cutting ■ Insert shape for uniform performance
KF (For carbon steel)	 <p>SECTION A-A</p> <ul style="list-style-type: none"> ■ Smaller chisel improves wear resistance at center for machining carbon steel. ■ Improved cutting edge design by higher rake angle (α°) ■ Longer tool life and better cutting performance with the use of excellent blade design
KH (For high hardness steel)	 <p>SECTION A-A</p> <ul style="list-style-type: none"> ■ Center shape proper for machining high hardness workpiece and uniformed tool life at center part ■ Improved cutting edge design by higher rake angle (α°) ■ Lower relief angle(β°) increases strength of cutting edges than universal inserts.

Exclusive for carbon steel
with higher wear resistance
at center and improved
blade design

→ **Stable machining
possible**

Perfect combination
between center shape
and rake / relief angle for
machining high hardness
workpiece

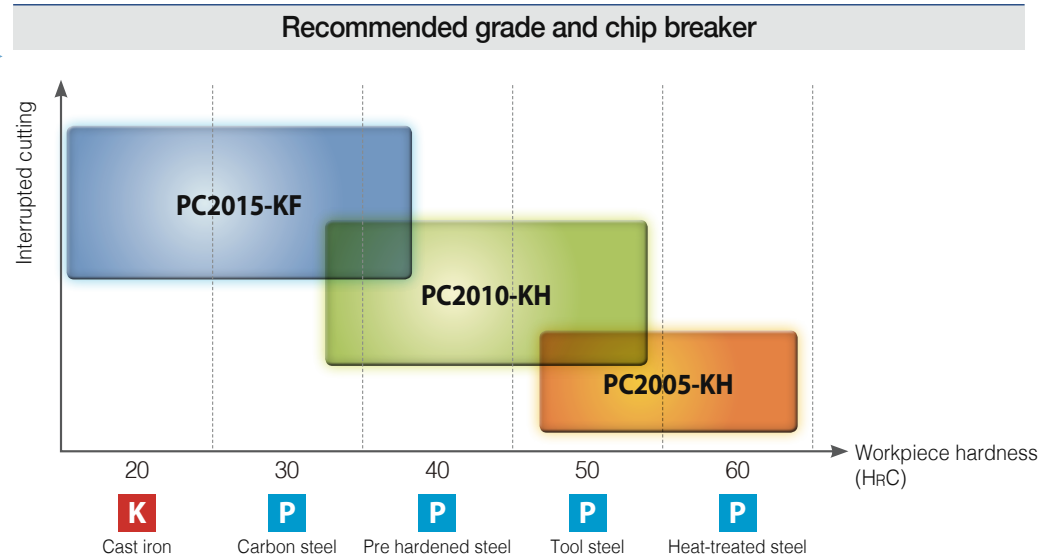
→ **Stronger insert**

➤ Application Guideline per Workpiece

• **PC2005-KH :**
Ideal for machining **heat-treated steel and high hardness steel** with its characteristics of excellent wear resistance and the harmony between improved blade design and strong chip breaker.

• **PC2010-KH :**
Ideal for machining **pre hardened steel** with its characteristics of the harmony between excellent thermal shock resistance and strong cutting edges.

• **PC2015-KF :**
Ideal for machining carbon steel with its characteristics of the harmony between excellent welding resistance and strong cutting edges/chip



➤ Recommended Cutting Conditions

Workpiece				Grade	Chip breaker	Recommended cutting conditions			
ISO	Material	HB(HRC)	vc(m/min)			fz(mm/t)	ap(mm)	ae(mm)	
K	Gray cast iron	GC250	180 (8)	PC2015 PC2010 PC2005	KF	130 - 210	0.2 - 0.5	0.07D	0.07D
	Ductile cast iron	GCD600	250 (24)						
P	Carbon steel	S20C - S50C	150			PC2010 PC2015 PC210F	KH	170 - 250	0.2 - 0.5
	Alloy steel	SCM21-SCM5H	270 (28)	130 - 210	0.1 - 0.3			0.7D	0.7D
	Pre hardened steel	KP4M	300 (32)	100 - 160	0.1 - 0.3			0.5D	0.5D
		NIMAX	370 (40)						
		CENA1	370 (40)						
		NAK80	400 (43)						
		STAVAX	510 (52)						
	High speed tool steel	SKH51 - SKH59	550 (55)	PC2005 PC2010	KH	80 - 130	0.1 - 0.2	0.3D	0.3D
	Alloy tool steel	STD61 (Hot forged)	630 (60)			70 - 120	0.1 - 0.2	0.3D	0.3D
		STD11 (Cold forged)							

When the overhang is over 3D, adjust the feed and reduce cutting speed as shown in the following table

Overhang	vc(m/min)	fz(mm/t)
Under 3D	100%	100%
3D - 5D	70%	70%
5D - 8D	60%	60%
8D - 10D	50%	50%

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➤ Application Example



Automobile press mold [X100CrMoV5 1 (DIN), hot forged steel]

- Cutting conditions vc (m/min) = 377, fz (mm/t) = 0.5, ap (mm) = 0.5, ae (mm) = 0.2, dry
- Tools

Insert	LBH250-KH (PC2005)
Holder	LBE250140S-S25C

PC2005	6,5hour/corner
Competitor	5hour/corner

30%
longer

➤ 30% longer cutting time per corner than competitor's



Automobile press mold [1.2738 improved (DIN)]

- Cutting conditions vc (m/min) = 200, fz (mm/t) = 0.1, ap (mm) = 0.1-0.5, ae (mm) = 0.1-0.5, wet
- Tools

Insert	LBH160-KH (PC2010)
Holder	LBE160100S-S16C

PC2010	10hour/corner
Competitor	8hour/corner

25%
longer

➤ 25% longer cutting time per corner than competitor's



CV Joint (C55, forged steel)

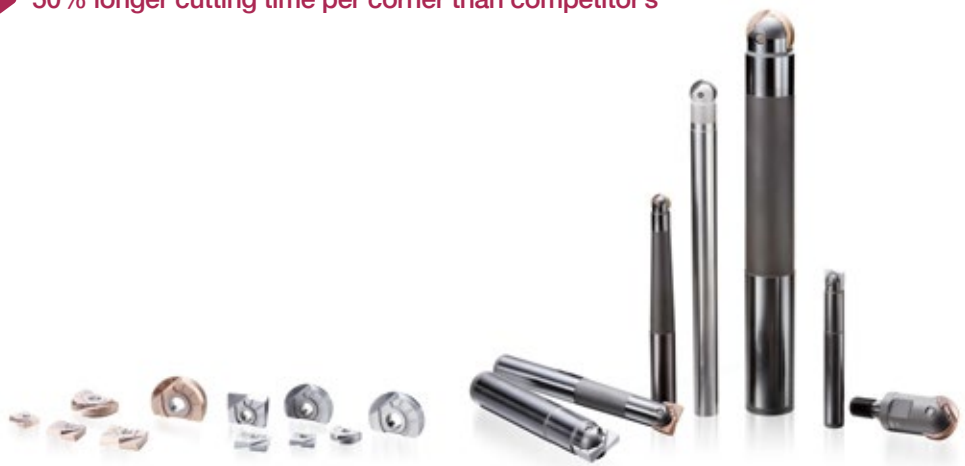
- Cutting conditions vc (m/min) = 200, fz (mm/t) = 0.25, ap (mm) = 0.5-2.0, ae (mm) = 0.5-1.0, dry
- Tools


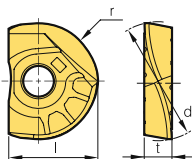

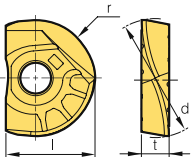
Insert	LBH230-KF (PC2015)
Holder	LBE230-HSKC63

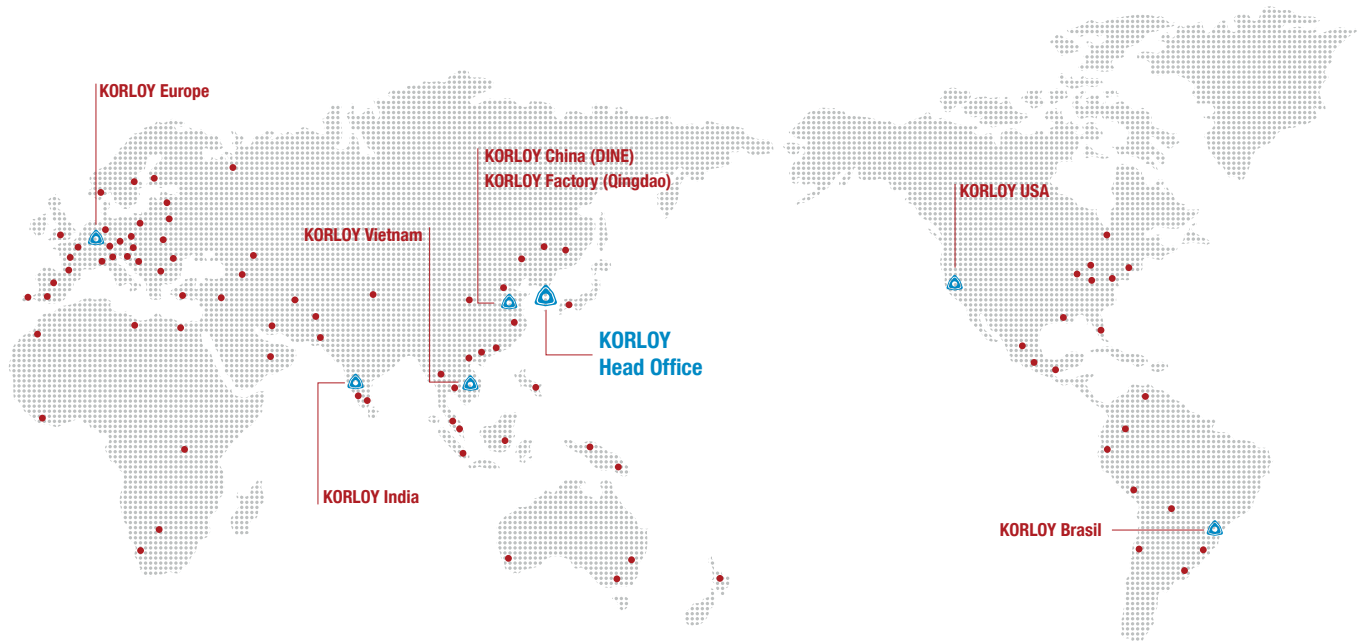
PC2015	300ea/corner
Competitor	200ea/corner

50%
longer

➤ 50% longer cutting time per corner than competitor's



Shape	Designation		Grade	Dimension (mm)				Fig.
				l	d	t	r	
	LBH	080-KF	PC2005	7.0	8	2.4	4	
		090-KF		7.5	9	2.4	4.5	
		100-KF		8.5	10	2.6	5	
		110-KF		9.0	11	2.6	5.5	
		120-KF		10.0	12	3.0	6	
		130-KF		10.5	13	3.0	6.5	
		160-KF		12.0	16	4.0	8	
		170-KF		12.5	17	4.0	8.5	
		200-KF		15.0	20	5.0	10	
		210-KF		15.5	21	5.0	10.5	
		250-KF		18.5	25	6.0	12.5	
		260-KF		19.0	26	6.0	13	
		300-KF		22.5	30	7.0	15	
		310-KF		23.0	31	7.0	15.5	
		320-KF		23.5	32	7.0	16	
	LBH	080-KH	PC2015	7.0	8	8	4	
		090-KH		7.5	9	9	4.5	
		100-KH		8.5	10	10	5	
		110-KH		9.0	11	11	5.5	
		120-KH		10.0	12	12	6	
		130-KH		10.5	13	13	6.5	
		160-KH		12.0	16	16	8	
		170-KH		12.5	17	17	8.5	
		200-KH		15.0	20	20	10	
		210-KH		15.5	21	21	10.5	
		250-KH		18.5	25	25	12.5	
		260-KH		19.0	26	26	13	
		300-KH		22.5	30	30	15	
		310-KH		23.0	31	31	15.5	
		320-KH		23.5	32	32	16	



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